NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Chapter 9

Alternative Actions

Final

Supplemental Generic Environmental Impact Statement

Chapter 9 – Alternative Actions

TABLES

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Chapter 9 ALTERNATIVE ACTIONS

Chapter 21 of the 1992 GEIS and the 1992 Findings Statement discussed a range of alternatives concerning oil and gas resource development in New York State that included both its prohibition and the removal of oil and gas industry regulation. Regulation as described by the 1992 GEIS was found to be the best alternative. Regulatory revisions recommended by the 1992 GEIS have been incorporated into permit conditions, which have been continuously improved since 1992.

The following alternatives to issuance of permits for high-volume hydraulic fracturing to develop the Marcellus Shale and other low-permeability gas reservoirs have been reviewed for the purpose of this SGEIS:

- The denial of permits to develop the Marcellus Shale and other low-permeability gas reservoirs by horizontal drilling and high-volume hydraulic fracturing (No-action alternative);
- The use of a phased-permitting approach to developing the Marcellus Shale and other low-permeability gas reservoirs, including consideration of limiting and/or restricting resource development in designated areas; and
- The required use of "green" or non-chemical fracturing technologies and additives.

9.1 No-Action Alternative

The no-action alternative to the proposed action would be denial of permits to drill where high-volume hydraulic fracturing is proposed and a prohibition on development of the Marcellus Shale and other low-permeability reservoirs using this method. If the no-action alternative were selected, none of the potential significant adverse impacts identified in this SGEIS would occur. Unlike any other activity regulated by the Department, the potential for significant adverse impacts is wide-ranging and widespread, including impacts to water resources, forests, ecosystems and wildlife, air resources, and greenhouse gas emissions across a substantial portion of the State. There are also potential significant community impacts, including increased truck traffic, wear and tear on roads and bridges, increased noise and light pollution and industrialization of rural landscapes.

The impacts to water resources that would be avoided by the no-action alternative merit special attention. Even with mitigation measures in place, the risk of spills and other unplanned events resulting in the discharge of toxic pollutants over a wide area would not be eliminated. Moreover, the level of risk such spills pose to public health is highly uncertain.

At the same time, if the no-action alternative is selected, none of the economic benefits identified in Chapters 2 and 6 would occur through the extraction of this energy resource. However, the no-action alternative would also eliminate the anticipated costs associated with properly regulating high-volume hydraulic fracturing. These costs include repairing and replacing local infrastructure, responding to increased demands on emergency services and health care providers and conducting oversight of permit applications and operations under the permits and the investigation and remediation of any spills or discharges which will inevitably occur during high-volume hydraulic fracturing development and transportation. These impacts and response costs have the potential to overwhelm local, county and State governments and their capacity to deal effectively with the multi-dimensional nature of the impacts of high-volume hydraulic fracturing. Indeed, the Department estimates that the cost of administering this program under the average development scenario would grow from $14 million in the first year to nearly $25 million in the fifth year. These costs do not consider the other substantial costs that would be incurred by other state agencies, which would nearly double the total State costs associated with regulating high-volume hydraulic fracturing, or the costs imposed on local agencies.

As more fully described in Chapter 2, the Marcellus Shale, which extends from Ohio through West Virginia and into Pennsylvania and New York, is attracting attention as a significant new source of natural gas production. In New York, the Marcellus Shale is located in much of the Southern Tier, stretching from Chautauqua and Erie counties in the west to the counties of Sullivan, Ulster, Greene and Albany in the east. According to Penn State University, the Marcellus Shale is the largest known shale deposit in the world. Engelder and Lash (2008) first estimated gas-in-place to be between 168 and 500 Tcf with a recoverable estimate of 50 Tcf.[549] While it is very early in the productive life of Marcellus Shale wells, more recent estimates by

[549] Considine et al., 2009, p. 2.

Engelder (2009) using well production decline rates indicate a 50% probability that recoverable reserves could be as high as 489 Tcf.[550]

The 2009 New York State Energy Plan recognized the potential benefit to New York from the strategic development of in-state energy resources, including renewable resources and natural gas:

> Production and use of in-state energy resources – renewable resources and natural gas – can increase the reliability and security of our energy systems, reduce energy costs, *and* contribute to meeting climate change and environmental objectives. To the extent that renewable resources and natural gas are able to displace the use of higher emitting fossil fuels, relying more heavily on these in-state resources will also reduce public health and environmental risks posed by all sectors that produce and use energy. Additionally, by focusing energy investments on in-state opportunities, New York can reduce the amount of dollars "exported" out of the State to pay for energy resources.[551]

The 2009 Energy Plan further included a recommendation to encourage development of the Marcellus Shale natural gas formation with environmental safeguards that are protective of water supplies and natural resources.[552] This recommendation, however, is premised on the assumption that the development of the Marcellus Shale can be done in an environmentally sound manner. If, on the other hand that development cannot be done safely, or if there remain substantial public health and environmental impacts and increasing uncertainty as to those potential impacts or, correspondingly, the effectiveness of proposed safeguards, permitting development of the resource would be inconsistent with the caution expressed in the recommendation. Indeed, the most recent draft State Energy Plan (2014) excludes any mention of support for development of high-volume hydraulic fracturing.

Furthermore, the 2009 Energy Plan and the draft 2014 Energy Plan recognize that in order to achieve its overall greenhouse gas (GHG) emission reduction goals, the State must continue to transition from fossil fuels to non-emitting clean energy sources. Increased availability of low-cost natural gas has the potential to reduce the cost-effectiveness of investment in various types

[550] Considine et al., 2009, p. 2.

[551] NYS Energy Planning Board, August 2009.

[552] NYS Energy Planning Board, August 2009.

of renewable energy and energy efficiency, thereby suppressing investment in and use of these clean energy technologies. While natural gas may serve as a “bridge” or “transitional fuel” towards greater utilization of non-emitting clean energy sources, increased natural gas development could extend the use of fossil fuels, or delay the necessary deployment of clean energy.

The New York State Commission on Asset Maximization recommends that “Taking into account the significant environmental considerations, the State should study the potential for new private investment in extracting natural gas in the Marcellus Shale on State-owned lands, in addition to development on private lands.” The Final report concluded that an increase in natural gas supplies would place downward pressure on natural gas prices, improve system reliability and result in lower energy costs for New Yorkers. In addition, natural gas extraction would create jobs, provide income to upstate landowners, and increase State revenue from taxes and landowner leases and royalties. Development of State-owned lands could provide much needed revenue relief to the State and spur economic development and job creation in economically depressed regions of the State.[553] However, as noted above, this recommendation fails to consider the environmental and public health impacts of high-volume hydraulic fracturing and the costs associated with allowing and/or properly regulating high-volume hydraulic fracturing.

9.2 Phased Permitting Approach

The use of a phased-permitting approach to developing the Marcellus Shale and other low-permeability gas reservoirs, including consideration of limiting and restricting resource development in designated areas, was evaluated. Phased permitting would potentially place a temporal and/or geographic limit on impacts from high-volume hydraulic fracturing operations to the extent such limits were less than the annual demand for well permits. The proposed mitigation considered in Chapter 7 would partially adopt this alternative by restricting resource development in the NYC and Syracuse watersheds (plus buffer), public water supplies, primary aquifers and certain state lands. In addition, restrictions and setbacks relating to development in other areas near public water supplies, principal aquifers and other resources as outlined within this SGEIS, would further limit the areas with site disturbances.

[553] NYS Commission on Asset Maximization, June 2009.

A formal phasing plan is not practical because of the inherent difficulties in predicting gas well development rates and patterns for a particular region or part of the State. In addition, the Department's prior experience with well drilling in the State and its review of the development of high-volume hydraulic fracturing in other states suggests that well development tends to occur in phases and increase over time without a formal government mandate.

9.2.1 Inherent Difficulties in Predicting Gas Well Development Rates and Patterns

The level of impact on a regional basis would be determined by the amount of development and the rate at which it occurs. Accurately estimating this is inherently difficult due to the wide and variable range of the resource; rig, equipment and crew availability; permitting and oversight capacity; leasing, and most importantly economic factors. This holds true regardless of the type of drilling and stimulation utilized.

9.2.2 Known Tendency for Development to Occur in Phases without Government Intervention

Upon completion of this Supplement, permit issuance and drilling would start slowly as services and equipment are mobilized to the area and the Department gains experience in implementing the enhanced application review procedures. The drilling rate would ramp up over a number of years until it reaches a peak, and would then ramp down over several years until full-field development is reached.[554]

In Pennsylvania, where the Marcellus play covers a larger area and development has already occurred, the number of permits issued has increased in recent years as indicated in Table 9.1. (The source data provides information on the number of permits issued and is not indicative of the number of wells drilled.)[555]

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[554] ALL Consulting, 2010, p. 6

[555] NTC Consultants, 2011, p. 36

Table 9.1 - Marcellus Permits Issued in Pennsylvania, 2007 - 2010

Year	Marcellus Permits Issued (Pennsylvania)
2007	99
2008	529
2009	1,991
2010	3,446

It is unknown whether the peak development rate has been reached in Pennsylvania, or how long it will take to reach full-field development in either Pennsylvania or New York. In general, however, the stages of development of a natural gas play can be grouped into five general categories: Exploration/Early Development, Moderate Development, Large-Scale Development, Post-Development Production and Closure and Reclamation. These stages are not discrete, but overlap and may occur concurrently in different areas. For example, initial production may begin during early development and well pads may be closed and reclaimed in one area as production continues elsewhere. In addition, development levels wax and wane as prices vary and technological advances occur.[556]

9.2.3 Prohibitions and Limits that Function as a Partial Phased Permitting Approach

As set forth below, the proposed mitigation considered in Chapter 7 would partially adopt a phased approach because it would restrict resource development in certain areas. In addition, restrictions and setbacks relating to development in other areas near public water supplies, principal aquifers and other resources as outlined within this SGEIS, would further limit the areas where site disturbances would be allowed for a certain period of time.

9.2.3.1 Permanent Prohibitions

The Department would not approve well pads for high-volume hydraulic fracturing:

- Within the NYC and Syracuse watersheds, or within a 4,000-foot buffer around those watersheds;
- Within 500 feet of private drinking water wells or domestic use springs, unless waived by the owner;

[556] Dutton and Blankenship 2010, p. 7.

- Within 100-year floodplains; and
- On certain state-owned land.

These limits would function as a partial "phased" permitting approach because they would prohibit activities in areas deemed to be especially sensitive. As reflected in the response to comments, subsequent to the issuance of the 2011 dSGEIS, the Department considered additional mitigation measures, such as banning any high-volume hydraulic fracturing development in the Catskill Park and eliminating sunset periods for various restrictions, in the face of ever increasing information detailing the actual environmental and public health impacts that result from high-volume hydraulic fracturing development.

9.2.3.2 Prohibitions in Place for at Least 3 Years

The Department would not approve well pads for high-volume hydraulic fracturing within 2,000 feet of public water supply wells, river or stream intakes or reservoirs until at least 3 years after issuance of the first permit for high-volume hydraulic fracturing. Reconsideration of this prohibition at that time would be based on actual experience and impacts associated with permit issuance outside these buffer zones. This approach functions as a partial "phased" permitting approach because it prohibits and limits activities in areas deemed to be especially sensitive where a phased and cautious approach is merited.

9.2.3.3 Prohibitions in Place for At Least 2 Years

The Department would not approve well pads for high-volume hydraulic fracturing within 500 feet of primary aquifers until at least 2 years after issuance of the first permit for high-volume hydraulic fracturing. Furthermore, during this time, the Department also would require site-specific SEQRA determinations of significance for proposed well pads within 500 feet of principal aquifers. Reconsideration of these restrictions after two years would be based on actual experience and impacts associated with permit issuance outside these buffer zones. These limits would function as a partial "phased" permitting approach because they would prohibit and limit activities in areas deemed to be especially sensitive where a phased and cautious approach is merited.

9.2.4 *Permit Issuance Matched to Department Resources*

The Department believes that any specific annual limit on the number of well permits to be issued would have to be tied to specific environmental, public health or community impacts to avoid a claim that the Department acted without a reasonable basis. The Department recognizes that the risk of significant adverse impacts has the potential to increase if permits were issued in excess of the Department's capacity to adequately police such development and enforce permit conditions. Accordingly, if permitting were allowed to proceed, the Department would consider a limitation on the number of permits it issues to match the Department resources that are made available to review and approve permit applications and to adequately inspect well pads and enforce permit conditions and regulations.

9.3 "Green" or Non-Chemical Fracturing Technologies and Additives

Hydraulic fracturing operations involve the use of significant quantities of additives/products, albeit in low concentrations, which potentially could have an adverse impact on the environment if not properly controlled. The recognition of potential hazards has motivated investigation into environmentally-friendly alternatives for hydraulic fracturing technologies and chemical additives.[557]

It is important to note that use of 'environmentally friendly' or "green" alternatives may reduce, but not entirely eliminate, adverse environmental impacts. Therefore, further research into each alternative is warranted to fully understand the potential environmental impacts and benefits of using any of the alternatives. In addition, the claimed benefits of such alternatives would need to be evaluated in a holistic manner, considering the full lifecycle impact of the technology or chemical.[558]

URS reports that the following environmentally-friendly technology alternatives have been identified as being in use in the Marcellus Shale, with other fracturing/stimulation applications or under investigation for possible use in Marcellus Shale operations:

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557 URS, 2009, pp. 6-1 - 6-7.

558 URS, 2009, pp. 6-1 - 6-7.

Liquid CO_2 alternative – The use of a liquid CO_2 and proppant mixture reduces the use of other additives [19]. CO_2 vaporizes, leaving only the proppant in the fractures. The use of this technique in the United States has been limited to demonstrations or pilots [20]. The appropriate level of environmental review for this alternative, if proposed in New York, would be determined at the time of application;

Nitrogen-based foam alternative – Nitrogen-based foam fracturing was used in vertical shale wells in the Appalachian Basin until recently [21]. Nitrogen gas is unable to carry appreciable amounts of proppant and the nitrogen foam was found to introduce liquid components that can cause formation damage [22]. Nitrogen-based foam fracturing is discussed starting on page 9-27 of the 1992 GEIS (Volume 1); and

Liquefied Petroleum Gas (LPG) alternative – The use of LPG, consisting primarily of propane, has the advantages of carbon dioxide and nitrogen cited above; additionally, LPG is known to be a good carrier of proppant due to the higher viscosity of propane gel [55]. Further, mixing LPG with natural gas does not 'contaminate' natural gas; and the mixture may be flowed directly into a gas pipeline and separated at the gas plant and recycled [55]. LPG's high volatility, low weight, and high recovery potential make it a good fracturing agent. Use of LPG as a hydraulic fracturing fluid also inhibits formation damage which can occur during hydraulic fracturing with conventional fluids. Using propane not only minimizes formation damage, but also eliminates the need to source water for hydraulic fracturing, recover flowback fluids to the surface and dispose of the flowback fluids.[559] As a result of the elimination of hydraulic fracturing source water, truck traffic to and from the wellsite would be greatly reduced. In addition, since LPG is less reactive with the formation matrix, it is therefore less likely to mobilize constituents which could increase NORM levels in the flowback fluid. LPG is discussed and addressed in the 1992 GEIS in the context of the permitting of underground gas storage wells and facilities in the State. Currently, there are three operating underground LPG storage facilities and associated wells for the injection and withdrawal of LPG, with a total storage capacity of approximately 150 million gallons of LPG. It is quite possible

[559] Smith, 2008, p. 3.

that these storage facilities which are located in Cortland, Schuyler and Steuben Counties could supply the LPG needed to conduct hydraulic fracturing operations at wells targeting the Marcellus Shale and other low-permeability gas reservoirs should a well operator make such a proposal for the Department's approval.

Well applications that specify and propose the use of LPG as the primary carrier fluid will be reviewed and permitted pursuant to the 1992 GEIS and Findings Statement. Horizontal and directional wells, which are part of the main subject of this SGEIS, are already in use in the Marcellus Shale. While these drilling techniques require larger quantities of water and additives per well because of the relatively longer target interval, horizontal and directional wells are considered to be more environmentally-friendly because these types of wells provide access to a larger volume of gas/oil than a typical vertical well [20, 23].[560]

9.3.1 Environmentally-Friendly Chemical Alternatives

The use of alternative chemical additives in hydraulic fracturing is another facet to the "environmentally- friendly" development in recent years.

There are several US-based chemical suppliers who advertise "green" hydraulic fracturing additives. Examples include: Earth-friendly GreenSlurry system from Schlumberger used in both the U.K. North Sea and the Gulf of Mexico [29]; Ecosurf EH surfactants by Dow Chemicals; CleanStim by Halliburton; and "Green" Chemicals for the North Sea from BASF. The EPA has published the twelve principles of "green" chemistry and a sustainable chemistry hierarchy [30], yet these do not provide a common measure of environmental benefits to assess "green" hydraulic fracturing additives.[561]

Although several US-based chemicals suppliers advertise "green" chemicals, there does not seem to be a US-based metric to evaluate the environmental benefits of these chemicals.[562] The most significant environmentally conscious hydraulic fracturing operations and regulations to date are

[560] URS, 2009, pp. 6-1 - 6-7.

[561] URS, 2009, pp. 6-1 - 6-7.

[562] URS, 2009, pp. 6-1 - 6-7.

likely in the North Sea. Several countries have established criteria that define environmentally beneficial chemicals and utilize models and databases to track chemicals' overall hazardousness against those criteria. Similar to the Department, the regulatory authorities in Europe request proprietary information from chemicals suppliers, and do not release any proprietary information into the public domain. The proprietary recipes for chemical additives are used to assess their potential hazard to the environment, and regulate their use as necessary.[563] In addition, the manufacturers of these "green" alternatives point out that they are not effective under some conditions. For example, where high clay content is found in the shale formation, a petroleum distillate may be needed to carry compounds designed to address the difficulties created by the clay. It is, therefore, not evident that the ability of operators to choose the most effective fluids to perform hydraulic fracturing can be reasonably circumscribed by government restrictions at this time.

9.3.2 Summary

As the Marcellus Shale and other shale plays across the United States are developed, the development and use of "green chemicals" will proceed based on the characteristics of each play and the potential environmental impacts of the development. While more research and approval criteria would be necessary to establish benchmarks for "green chemicals", this SGEIS considers thresholds, permit conditions and review criteria to reduce or mitigate potential environmental impacts for development of the Marcellus Shale and other low-permeability gas reservoirs using high volume hydraulic fracturing. It also considers requiring that applicants evaluate and, where feasible, use alternative additive products that may pose less risk to the environment, including water resources. It also considers public disclosure of the additives, including additive MSDSs, used at each well. These requirements could be altered and/or expanded as clearer evidence emerges that the use of "green chemicals" can provide reasonable alternatives as the appropriate technology, criteria, and processes are developed to evaluate and produce "green chemicals."

[563] URS, 2009, pp. 6-1 - 6-7.

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